

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claims 1-10 (Cancelled)

11. (Currently amended) A method for manufacturing a semiconductor integrated circuit device including a MIS transistor structure, the method comprising the steps of:

(a) forming a first gate insulating film for forming the MIS transistor structure on a main surface of a semiconductor substrate;

(b) forming at least one pair of ~~laminating~~laminated structure bodies each including two layers of a first gate electrode covering a part of said first gate insulating film and a first insulating film covering said first gate electrode, an etching prevention film being formed on a sidewall portion of said first insulating film but so as not to cover sidewall portions of said first gate electrode;

(c) introducing impurities into said semiconductor substrate through said first gate insulating film located in a region not covered with said ~~laminating~~laminated

structure bodies, and thereby forming a first impurity introduced region self-aligned with said ~~laminating~~laminated structure bodies on the main surface of said semiconductor substrate;

(d) removing said first gate insulating film in the region not covered with said ~~laminating~~laminated structure bodies after said step (c); and

(e) forming a second insulating film covering upper portions and sidewall portions of said ~~laminating~~laminated structure bodies after said step (d).

12. (Original) The method for manufacturing a semiconductor integrated circuit device according to claim 11, further comprising a step of:

(d-2) oxidizing the main surface of said semiconductor substrate in a region from which said first gate insulating film is removed, and thereby forming an insulating film on said main surface, between said steps (d) and (e).

13. (Currently amended) The method for manufacturing a semiconductor integrated circuit device according to claim 12, further comprising the steps of:

(f) forming a third insulating film over said second insulating film so as to cover said ~~laminating~~laminated structure bodies covered with said second insulating film and to embed each space between said ~~laminating~~laminated structure bodies; and

(g) forming a mask for a contact hole over said third insulating film, and selectively removing said third insulating film and said second insulating film in a laminating direction thereof by anisotropic etching using said mask, and thereby forming the contact hole which penetrates said third insulating film and said second insulating film and which reaches a surface of said first impurity introduced region.

14. (Original) The method for manufacturing a semiconductor integrated circuit device according to claim 13, further comprising a step of:

(h) forming a wiring conductive layer embedding said contact hole and electrically connected to said first impurity introduced region, after said step (g).

15. (Currently amended) The method for manufacturing a semiconductor integrated circuit device according to claim 14,

wherein a second gate insulating film and a second gate electrode laminated on an upper portion thereof are interposed between said first gate electrode and said first insulating film ~~constituting of~~ each of said ~~laminating laminated~~ structure bodies.

16 (Currently amended) The method for manufacturing a semiconductor integrated circuit device according to claim 14,

wherein said first insulating film consists of a silicon oxide film, with or without a laminating silicon nitride film, said first gate insulating film, ~~said first insulating film~~ and said third insulating film each consist of a silicon oxide film, and said etching prevention film and said second insulating film each consist of a silicon nitride film.

17. (Original) The method for manufacturing a semiconductor integrated circuit device according to claim 16,

wherein said first gate electrode and said second gate electrode consist of a polycrystalline silicon film, and said second gate insulating film consists of a three-layer film in which a silicon oxide film, a silicon nitride film and a silicon oxide film are laminated in this order.

18. (Original) The method for manufacturing a semiconductor integrated circuit device according to claim 17,

wherein said first insulating film consists of a two-layer film in which a silicon oxide film and a silicon nitride film are laminated in this order, and said etching prevention film is formed to cover a sidewall portion of said two-layer film.

19. (Currently amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming, on a main surface of a semiconductor substrate, a first gate insulating film consisting of a silicon oxide film, and forming a first conductive film, a second gate insulating film and a second conductive film over said first gate insulating film in this order:

(b) forming a first protection insulating film consisting of a single layer silicon oxide film formed over said second conductive film, with or without a laminating silicon nitride film formed over the silicon oxide film;

(c) patterning said first protection insulating film, and thereby forming an etching mask consisting of said first protection insulating film;

(d) patterning said second conductive film, said second gate insulating film and said first conductive film in this order by dry etching using said etching mask as a mask, and thereby forming a plurality of gate electrodes that each have a floating gate electrode formed by a portion of said first conductive film and a control gate electrode formed by a portion of said second conductive film and that each have a ~~laminating~~laminated structure in which an upper portion of said control gate electrode is covered with said first protection insulating film;

(e) forming an etching prevention film consisting of a silicon nitride film on the patterned first protection insulating film, after said step (c) and before said step (d), or after said step (d), said etching prevention film being formed on both sidewall portions of the patterned first protection insulating film but so as not to cover

sidewall portions of said floating gate electrode and said control gate electrode formed in said step (d);

(f) introducing impurities into the main surface of said semiconductor substrate located between sidewall portions facing each other in said plurality of gate electrodes, and thereby forming a source region and a drain region;

(g) treating a surface of said semiconductor substrate by using etchant containing a hydrofluoric acid after said step (f), and thereby cleaning said first gate insulating film located between the sidewall portions which face each other in said plurality of gate electrodes;

(h) covering an upper portion and both sidewall portions of each of said plurality of gate electrodes after said step (g), and forming a second protection insulating film consisting of a silicon nitride film having such a thickness as to partially embed a region between the sidewall portions which face each other in said plurality of gate electrodes;

(i) forming, on an upper portion of said second protection insulating film, an interlayer insulating film consisting of a silicon oxide film, and embedding, with said interlayer insulating film, the region between the

sidewall portions which face each other in said plurality of gate electrodes;

(j) etching said interlayer insulating film and said second protection insulating film located between the sidewall portions which face each other in said plurality of gate electrodes, and thereby forming a first connection hole for exposing a surface of said source region and a second connection hole for exposing a surface of said drain region; and

(k) forming a third conductive film electrically connected to said source region inside said first connection hole, and forming a fourth conductive film electrically connected to said drain region inside said second connection hole.

20. (Original) The method for manufacturing a semiconductor integrated circuit device according to claim 19,

wherein said third conductive film formed inside said first connection hole functions as a part of a source line, and said fourth conductive film formed inside said second connection hole functions as a part of a data line.



21. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 20,

wherein each of said plurality of gate electrodes constitutes part of a respective memory cell of a flash memory, and writing into said memory cell is carried out by injecting a charge into said floating gate electrode thereof, and erasing from said memory cell is carried out by discharging, to said semiconductor substrate, said charge injected into said floating gate electrode thereof.

22. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 17,

wherein said flash memory is an NOR type flash memory.

23. (Currently amended) The method for manufacturing a semiconductor integrated circuit device according to claim 11,

wherein each of said at least one pair of ~~laminating~~laminated structure bodies constitutes a memory cell of a flash memory, and writing into said memory cell

is carried out by injecting a charge into said floating gate electrode.

24. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 23,

wherein said flash memory is an NOR type flash memory.

25. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 19,

wherein said step (g) is conducted so that said first gate insulating film retreats beneath opposite sidewall portions of said floating gate electrode.

26. (Currently amended) A method for manufacturing a semiconductor integrated circuit device having an MIS transistor structure of a flash memory, comprising the steps of:

(a) forming, on a main surface of a semiconductor substrate, a first gate insulating film, and forming a first conductive film, a second gate insulating film and a

second conductive film over said first gate insulating film in this order;

(b) forming a first protection insulating film consisting of a single layer silicon oxide film formed over said second conductive film, with or without a laminating silicon nitride film formed over the silicon oxide film;

(c) patterning said first protection insulating film, and thereby forming an etching mask consisting of said first protection insulating film;

(d) patterning said second conductive film, said second gate insulating film and said first conductive film in this order by dry etching using said etching mask as a mask, and thereby forming a plurality of gate electrodes that each have a floating gate electrode formed by a portion of said first conductive film and a control gate electrode formed by a portion of said second conductive film and that each have a ~~laminating~~laminated structure in which an upper portion of said control gate electrode is covered with said first protection insulating film;

(e) forming an etching prevention film consisting of a silicon nitride film on the patterned first protection insulating film, after said step (c) and before said step (d), or after said step (d), said etching prevention film

being formed on both sidewall portions of the patterned first protection insulating film but so as not to cover sidewall portions of said floating gate electrode and said control gate electrode formed in said step (d);

(f) introducing impurities into the main surface of said semiconductor substrate located between sidewall portions facing each other in said plurality of gate electrodes, and thereby forming a source region and a drain region;

(g) treating a surface of said semiconductor substrate by using etchant after said step (f);

(h) covering an upper portion and both sidewall portions of each of said plurality of gate electrodes after said step (g), and forming a second protection insulating film consisting of a silicon nitride film having such a thickness as to partially embed a region between the sidewall portions which face each other in said plurality of gate electrodes;

(i) forming, on an upper portion of said second protection insulating film, an interlayer insulating film consisting of a silicon oxide film, and embedding, with said interlayer insulating film, the region between the

sidewall portions which face each other in said plurality of gate electrodes;

(j) etching said interlayer insulating film and said second protection insulating film located between the sidewall portions which face each other in said plurality of gate electrodes, and thereby forming a first connection hole for exposing a surface of said source region and a second connection hole for exposing a surface of said drain region.

27. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 26, further comprising the steps of:

(k) forming a third conductive film electrically connected to said source region inside said first connection hole, and forming a fourth conductive film electrically connected to said drain region inside said second connection hole.

28. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 27,

wherein said third conductive film formed inside said first connection hole functions as a part of a source line, and said fourth conductive film formed inside said second connection hole functions as a part of a data line.

29. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 28,

wherein each of said plurality of gate electrodes constitutes part of a respective memory cell of a flash memory, and writing into said memory cell is carried out by injecting a charge into said floating gate electrode thereof, and erasing from said memory cell is carried out by discharging, to said semiconductor substrate, said charge injected into said floating gate electrode thereof.

30. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 26,

wherein said flash memory is a NOR type flash memory.

31. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 26,

wherein said step (g) is conducted so that said first gate insulating film retreats beneath opposite sidewall portions of said floating gate electrode.

32. (Previously presented) The method for manufacturing a semiconductor integrated circuit device according to claim 11, wherein said step (d) is conducted such that said first gate insulating film retreats beneath opposite sidewall portions of said first gate electrode.

33. (New) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a first gate insulating film for forming a field effect transistor structure on a main surface of a semiconductor substrate;

(b) forming at least one pair of laminated structure bodies each including two layers of a first gate electrode covering a part of said first gate insulating film and a first insulating film covering said first gate electrode, an etching prevention film being formed on a sidewall

portion of said first insulating film but so as not to cover sidewall portions of said first gate electrode; and

(c) removing said first gate insulating film in a region not covered with said laminated structure bodies after said step (b).

34. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 33, further comprising the step of:

(d) after said step (c), oxidizing the main surface of said semiconductor substrate in a region from which said first gate insulating film is removed, and thereby forming an insulating film on said main surface.

35. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 33, further comprising the steps of:

(d) after said step (c), forming a second insulating film covering upper portions and sidewall portions of said laminated structure bodies;

(e) forming a third insulating film over said second insulating film so as to cover said laminated structure bodies covered with said second insulating film and to



embed each space between said laminated structure bodies;  
and

(f) removing portions of said third insulating film by etching said third insulating film at a faster etching rate than said second insulating film, and thereby forming a contact hole in said third insulating film.

36. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 35, further comprising the step of:

(g) forming a wiring conductive layer embedding said contact hole, after said step (f).

37. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 33,

wherein a second gate insulating film and a second gate electrode laminated on an upper portion thereof are interposed between said first gate electrode and said first insulating film of each of said laminated structure bodies.

38. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 35,

wherein said first insulating film consists of a silicon oxide film, with or without a laminating silicon nitride film, said first gate insulating film and said third insulating film each consist of a silicon oxide film, and said etching prevention film and said second insulating film each consist of a silicon nitride film.

39. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 37,

wherein said first gate electrode and said second gate electrode each consist of a polycrystalline silicon film, and said second gate insulating film consists of a three-layer film in which a silicon oxide film, a silicon nitride film, and a silicon oxide film are laminated in this order.

40. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 33,

wherein said first insulating film consists of a two-layer film in which a silicon oxide film and a silicon nitride film are laminated in this order, and said etching prevention film is formed so as to cover a sidewall portion of said two-layer film.

41. (New) The method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming, on a main surface of a semiconductor substrate, a first gate insulating film consisting of a silicon oxide film, and forming a first conductive film, a second gate insulating film and a second conductive film over said first gate insulating film in this order;

(b) forming a first protection insulating film consisting of a single layer silicon oxide film formed over said second conductive film, with or without a laminating silicon nitride film formed over the silicon oxide film;

(c) patterning said first protection insulating film, and thereby forming an etching mask consisting of said first protection insulating film,

(d) patterning said second conductive film, said second gate insulating film and said first conductive film

in this order by dry etching using said etching mask as a mask, and thereby forming a plurality of gate electrodes that each have a floating gate electrode formed by a portion of said first conductive film and a control gate electrode formed by a portion of said second conductive film and that each have a laminated structure in which an upper portion of said control gate electrode is covered with said first protection insulating film;

(e) forming an etching prevention film consisting of a silicon nitride film on the patterned first protection insulating film, after said step (c) and before said step (d), or after said step (d), said etching prevention film being formed on both sidewall portions of the patterned first protection insulating film but so as not to cover sidewall portions of said floating gate electrode and said control gate electrode formed in said step (d);

(f) treating a surface of said semiconductor substrate by using etchant containing a hydrofluoric acid after said step (e), and thereby cleaning said first gate insulating film located between the sidewall portions which face each other in said plurality of gate electrodes;

(g) covering an upper portion and both sidewall portions of each of said plurality of gate electrodes after

said step (f), and forming a second protection insulating film consisting of a silicon nitride film having such a thickness as to partially embed a region between the sidewall portions which face each other in said plurality of gate electrodes;

(h) forming, on an upper portion of said second protection insulating film, an interlayer insulating film consisting of a silicon oxide film, and embedding, with said interlayer insulating film, the region between the sidewall portions which face each other in said plurality of gate electrodes; and

(i) etching said interlayer insulating film and said second protection insulating film located between the sidewall portions which face each other in said plurality of gate electrodes, and thereby forming a connection hole.

42. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 41,

wherein each of said plurality of gate electrodes constitutes part of a respective memory cell of a flash memory, and writing into said memory cell is carried out by injecting a charge into said floating gate electrode

thereof, and erasing from said memory cell is carried out by discharging, to said semiconductor substrate, said charge injected into said floating gate electrode thereof.

43. (New) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming, over a main surface a semiconductor substrate, a first gate insulating film for forming a MIS transistor structure;

(b) forming at least one pair of laminated structure bodies each including two layers of a first gate electrode covering part of said first gate insulating film and a first insulating film covering said first gate electrode and in each of which an etching prevention film is formed on a sidewall portion of said first insulating film but so as not to cover sidewall portions of said first gate electrode; and

(c) after said step (b), cleaning a region of said first gate insulating film not covered with said laminated structure bodies.

44. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 43, further comprising the step of:

after said step (c), forming an insulating film on said main surface by oxidizing said main surface in a region where said first gate insulating film has been cleaned.

45. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 43, further comprising the steps of:

(d) after said step (c), forming a second insulating film covering upper portions and sidewall portions of said laminated structure bodies;

(e) forming a third insulating film on said second insulating film so as to cover said laminated structure bodies covered with said second insulating film and to be embedded in each space between said laminated structure bodies; and

(f) removing portions of said third insulating film by etching said third insulating film at a faster etching rate than said second insulating film, and thereby forming a contact hole in said third insulating film.

46. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 45, further comprising the step of:

(g) after said step (f), forming a wiring conductive layer embedding said contact hole.

47. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 43,

wherein a second gate insulating film and a second gate electrode laminated thereon are interposed between said first gate electrode and said first insulating film of each of said laminated structure bodies.

48. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 45,

wherein said first insulating film consists of a silicon oxide film, with or without a laminating silicon nitride film, said first gate insulating film and said third insulating film each consist of a silicon oxide film,



and said etching prevention film and said second insulating film each consist of a silicon nitride film.

49. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 47,

wherein said first gate electrode and said second gate electrode each consist of a polycrystalline silicon film, and said second gate insulating film consists of a three-layer film in which a silicon oxide film, a silicon nitride film and a silicon oxide film are laminated in this order.

50. (New) The method for manufacturing a semiconductor integrated circuit device according to claim 43,

wherein said first insulating film consists of a two-layer film in which a silicon oxide film and a silicon nitride film are laminated in this order, and said etching prevention film is formed so as to cover a sidewall portion of said two-layer film.